IPM3400 Compact Power Meter

User guide

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Chapter 1 Introduction

1.1 Product Introduction

IPM3400 series are designed for general single phase or poly phase power measurement, with wide range. it con be applied either on low voltage primary side or medium/high voltage secondary side for its high accuracy (<1%, IEC62053-21) under 5A current. IPM3400 equipped with clip-on CT, standard communication, small size and low cost.

Features：

1. True RMS energy and power parameters measurement in compact size。
2. clip-on CT, easy wiring for on-line installation。
3. RS485 communication support Modbus protocol。
4. Wh accuracy better than 0.5%(pf =1)。
5. Support Lon Talks (option)。
6. wild range of measurement with various size of CT , up to 200A(24Φmm) 。
7. LED pulse output。

1.2 Caution

1.2.1 Danger

The meter contains hazardous voltages. The meter should never be disassembled. Failure to observe this practice can result in serious injury or death. Any work on or near energized meters, meter sockets, or other metering equipment can present a danger of electrical shock. It is strongly recommended that all work should be performed only by qualified industrial electricians and metering specialist. IA Networks assumes no responsibility if your electrical installer does not follow the appropriate national and local electrical codes.

1.2.2 PRODUCT WARRANTY & CUSTOMER SUPPORT

IA Networks warrants all products free from defects in material and workmanship for a period of one year from the date of shipping. During the warranty period, we will, at our position, either repair any product that proves to be defective. To report any defect, please contact ：**+886-2-23953153** or **product_infor@iantech.com.tw**.

Please have the model, serial number and a detailed problem description available when you call. If the problem concerns a particular reading, please have all meter readings available. When returning any merchandise to IA Networks, a return SN. is required.

1.2.3 LIMITATION OF WARRANTY

This warranty does not apply to defects resulting from unauthorized modification, misuse, or use for reason other than electrical power monitoring. The supplied meter is not a user-serviceable product.

Chapter 2 Specification

Input V	10-300V
Input I	CT Φ10mm （60A）， CT Φ16mm（100A）、CT Φ24mm（ 200A）
Aux Power	DC 10-30V
Frequency	60/50Hz
Starting I	<0.025A
Wiring diagram	1-phase 4-channel
Power Parameters Measures	V1, V1, V2, V2 I 1, I 2, I 3, I 4 kW1, kW2, kW3, kW4 kVA1, kVA2, kVA3, kVA4 kvar1, kvar2, kvar3, kvar4 PF1, PF2, PF3, PF4 kWh1, kWh2, kWh3, kWh4 kVAh1, kVAh2, kVAh3, kVAh4 kvarh1, kvarh2, kvarh3, kvarh4 Frequency
Communication	RS485, half duplex isolated Baud Rate：9600, 19200(default), 38400 Protocol：Modbus LonTalks：(option)
kWh Accuracy	0.5%(PF=1)，better than IEC62053-21
Size	78(L) × 35(W) × 99(H) mm
Operation Temp	-10℃~60 ℃
Installation	Rail-mounted

Chapter3: Installation

3.1 Inspection

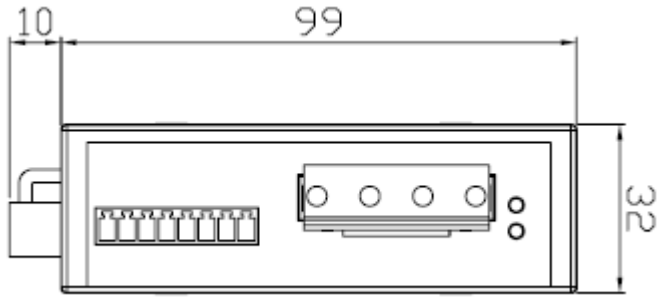
On receipt of the instrument and prior to installation, makes sure it has not been damaged during shipment.
The instrument is no longer safe when,
a) shows clear signs of damage
b) does not work
c) long storage under extreme conditions
d) damage during shipment

3.2 Safety

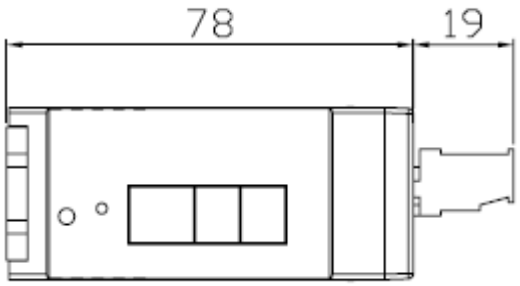
Please use the soft dry clothes to clean the instrument.
Please do not use any chemical or detergent or volatile solvents to clean the instrument, in order to avoid any possibility of the cover damage。

3.3 Size and Latch

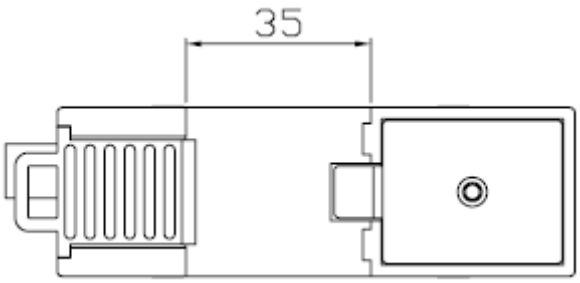
Top View (mm)



Side View (mm)



Position of latch

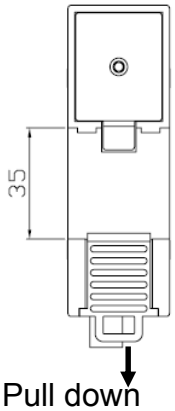


- Dimension of this product is 99mm（length）× 32mm（wide）× 78mm（high）
- Products come with external split type clip on CT's. Use only the attached CT's, and do not disconnect CT's from meter. and never direct connect the other CT's from the secondary side。
- Please read this operation manual carefully before using。
- Please re-confirm the measure position。
- IPM3400 can be installed as rail mounting mode or embedded, no need to drill a hole or screw to fix it（rail mounting width can up to the length of 35 mm ）。
- Meter auxiliary power for IPM3400 is DC 10V -30V。

3.4 Mounting and Dismounting

3.4.1 Mounting

Pull down the "latch" of meter, and mount the meter on to the rail and lock it, as shown in below picture.



3.4.2 Dismounting

- **Wire Disconnection**

1. Open the clicked CT first and remove CTS from lines，Do not disconnect CT from terminals.
2. Disconnect the voltage input wires from terminals and wrap the wire tips with plastic tape.
3. Disconnect the communication wires from terminal.
4. Disconnect the Aux power from terminal and wrap the wire tip with plastic tape.

- **Dismount**

From the back to pull down the latch, then can release the meter

Chapter 4 : Wiring Diagrams

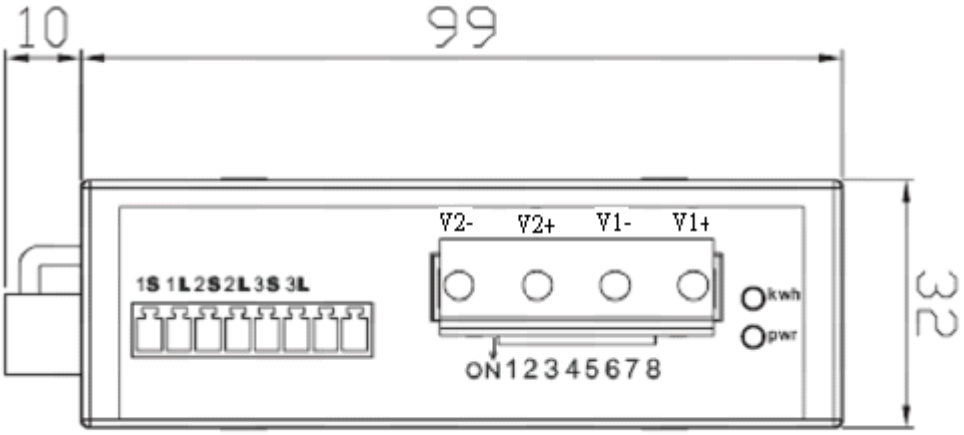
Voltage Input

- This instrument can measure voltage up to a maximum 300V. Higher than 300V, please add the PT in front to protect the instrument.
- Confirm the voltage.

Current Input

- The external CT's are friable, please handle with care.
- The current input for this instrument is in mA range. **Only the attached CT's can be used.** The normal CT's from panel will damage the instrument due to its large current (around 5A)
- When more than one instrument will be installed, please do not disconnect the CT with its instrument. Each instrument is calibrated with matching CT's.
- To install CT's, confirm the lines with terminals and latch on the split CT with each cable. (Detail will be found in next section)
- CT bending area is quite frangible; please handle with extra care, especially when the room between CT's is limited.
- The current direction must follow K-L marked on CT
- Please select the right size CT for different size current cables.
- The maximum current value can not exceed the CT rating.

4.1 Connection diagram

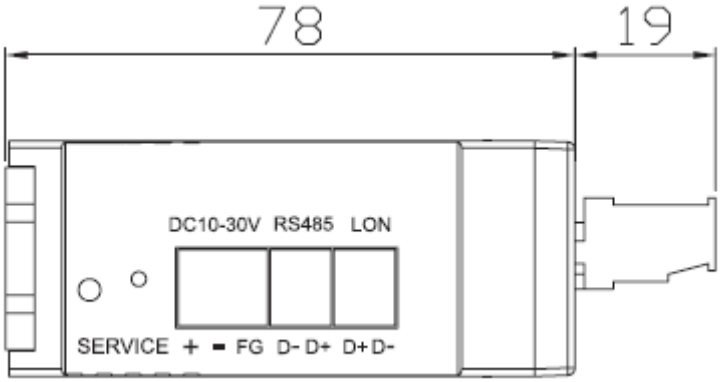


- **IPM3400**

Please first check the current input terminal, and follow the white black, white black, white black, white black wired order（1S 1L 2S 2L 3S 3L 4S 4L）.After connection the CT's, clip on CT's. Make sure the arrow sign on CT's follow current flow direction（K→L）**Note: it must in same direction**。

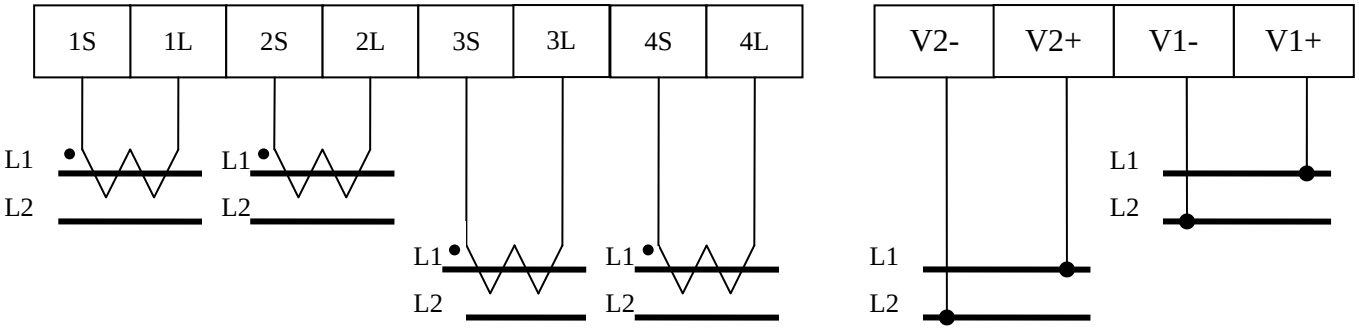
Connect the voltage input terminal. For IPM3400, connect V2- V2+ and V1- V1+。

Then, Connect RS485 D+ D- ，LonTalks D+ D- ("－", "＋" sequence base on the top cover mark showed)。And then, add the auxiliary power。DC10- 30V (+ - FG)



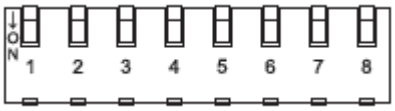
16Φ/100A 24Φ/200A

- **1P4W(IPM3400)**



Chapter 5 : Dip Switch ON /OFF

Dip Switch



Dip switch is used for Modbus address setting, default is 1 i.e. all OFF

For example : Modbus address is 10，find the table of dip switch 1-6 is **on, off, off, on, off, off**

- **SW1 -6 setting the Modbus address of communication, 1-64**

Modbus Address	1	2	3	4	5	6
1	OFF	OFF	OFF	OFF	OFF	OFF
2	ON	OFF	OFF	OFF	OFF	OFF
3	OFF	ON	OFF	OFF	OFF	OFF
4	ON	ON	OFF	OFF	OFF	OFF
5	OFF	OFF	ON	OFF	OFF	OFF
6	ON	OFF	ON	OFF	OFF	OFF
7	OFF	ON	ON	OFF	OFF	OFF
8	ON	ON	ON	OFF	OFF	OFF
9	OFF	OFF	OFF	ON	OFF	OFF
10	ON	OFF	OFF	ON	OFF	OFF
11	OFF	ON	OFF	ON	OFF	OFF
12	ON	ON	OFF	ON	OFF	OFF
13	OFF	OFF	ON	ON	OFF	OFF
14	ON	OFF	ON	ON	OFF	OFF
15	OFF	ON	ON	ON	OFF	OFF
16	ON	ON	ON	ON	OFF	OFF
17	OFF	OFF	OFF	OFF	ON	OFF
18	ON	OFF	OFF	OFF	ON	OFF
19	OFF	ON	OFF	OFF	ON	OFF
20	ON	ON	OFF	OFF	ON	OFF
21	OFF	OFF	ON	OFF	ON	OFF

22	ON	OFF	ON	OFF	ON	OFF
23	OFF	ON	ON	OFF	ON	OFF
24	ON	ON	ON	OFF	ON	OFF
25	OFF	OFF	OFF	ON	ON	OFF
26	ON	OFF	OFF	ON	ON	OFF
27	OFF	ON	OFF	ON	ON	OFF
28	ON	ON	OFF	ON	ON	OFF
29	OFF	OFF	ON	ON	ON	OFF
30	ON	OFF	ON	ON	ON	OFF
31	OFF	ON	ON	ON	ON	OFF
32	ON	ON	ON	ON	ON	OFF
33	OFF	OFF	OFF	OFF	OFF	ON
34	ON	OFF	OFF	OFF	OFF	ON
35	OFF	ON	OFF	OFF	OFF	ON
36	ON	ON	OFF	OFF	OFF	ON
37	OFF	OFF	ON	OFF	OFF	ON
38	ON	OFF	ON	OFF	OFF	ON
39	OFF	ON	ON	OFF	OFF	ON
40	ON	ON	ON	OFF	OFF	ON
41	OFF	OFF	OFF	ON	OFF	ON
42	ON	OFF	OFF	ON	OFF	ON
43	OFF	ON	OFF	ON	OFF	ON
44	ON	ON	OFF	ON	OFF	ON
45	OFF	OFF	ON	ON	OFF	ON
46	ON	OFF	ON	ON	OFF	ON
47	OFF	ON	ON	ON	OFF	ON
48	ON	ON	ON	ON	OFF	ON
49	OFF	OFF	OFF	OFF	ON	ON
50	ON	OFF	OFF	OFF	ON	ON
51	OFF	ON	OFF	OFF	ON	ON
52	ON	ON	OFF	OFF	ON	ON
53	OFF	OFF	ON	OFF	ON	ON
54	ON	OFF	ON	OFF	ON	ON
55	OFF	ON	ON	OFF	ON	ON
56	ON	ON	ON	OFF	ON	ON
57	OFF	OFF	OFF	ON	ON	ON
58	ON	OFF	OFF	ON	ON	ON
59	OFF	ON	OFF	ON	ON	ON
60	ON	ON	OFF	ON	ON	ON
61	OFF	OFF	ON	ON	ON	ON
62	ON	OFF	ON	ON	ON	ON
63	OFF	ON	ON	ON	ON	ON
64	ON	ON	ON	ON	ON	ON

- **SW7-8 are used to select Wh pulse output (IPM3400) to the LED for each of four channels**

IPM3400：Select Wh pulse output to LED

Wh pulse output	7	8
Wh1(ch1)	OFF	OFF
Wh2(ch2)	ON	OFF
Wh3(ch3)	OFF	ON
Wh4(ch4)	ON	ON

Chapter 6 communication Formats

6.1 Specifications

- **Communication protocol** :Modbus
- **Transport specification**

  Bits per Byte：1 start bit

  8 data bits, least significant bit sent first

  1 or 2 stop bits（default = 1, stop）

  Error Check：Cyclical Redundancy Check（CRC）
- **Baud Rate**：9600, 19200（default）, 38400
- **Modbus slave address**：1-64(default：1)
- **Modbus Function Code**：03h, 04h, 10h

Code	MODBUS_ name	Description
03h	Read Holding Registers	Read the contents of read/write location
04h	Read Input Registers	Read the contents of read only location
10h	Pre-set Multiple Registers	Set the contents of read/write location

Note: the max. data reading of Function 03 and Function04 is 125 registers

- **Format of data**

  Integer： 16 bits with sign

  Unsigned Integer：16 bits without sign

  Float：IEEE 754 Format ，each with 2 registers, Low Word is first priority while transmit

IEEE 754 Format

Definition of the floating format of the Bits

Data Hi Word， Hi Byte	Data Hi Word， Lo Byte	Data Lo Word， Hi Byte	Data Lo Word， Lo Byte
SEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM

$$\text{Value} = (-1)^{S} 2^{E-127}(1.M) \quad 0 < E < 255$$

Where:

S represents the sign bit where 1 is negative and 0 is positive

E is the two's complement exponent with an offset of 127. i.e. an exponent of zero is represented by 127, an exponent of 1 by 128 etc.

M is the 23-bit normal mantissa. The highest bit is always 1 and, therefore, is not stored.

- **transport sequence**

1	2	3	4
Data Lo Word，Hi Byte	Data Lo Word，Lo Byte	Data Hi Word，Hi Byte	Data Hi Word，Lo Byte

6.2 Modbus Register

Modbus Module #1 Holding Register : Setup Parameter

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicom Format	Hex						
Comm_485_BaudRate	44097	0x1000	Word	UInt	0: 9600 1: 19200 2: 38400	1	bps	
Comm_485_StopBit	44098	0x1001	Word	UInt	0:1 Stop bit, 1:2 Stop bit	0		
Meter_Ratio	44099	0x1002	Word	UInt	1-65535	500		
PT_Ratio	44100	0x1003	Word	UInt	1-65535	100	0.01	0.01-655.35 (V1.26)
						10	0.1	0.1-6553.5 (V1.00~V1.25)
CT_Ratio	44101	0x1004	Word	UInt	1-65535	1		

Modbus Module #2 Input Register : Voltage, Current, Power, Energy(Float) for IPM3400

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	34353-34354	0x1100-0x1101	DWord	Float		Volt	Primary
I_a	34355-34356	0x1102-0x1103	DWord	Float		Amp	Primary
kW_a	34357-34358	0x1104-0x1105	DWord	Float		kW	Primary
kvar_a	34359-34360	0x1106-0x1107	DWord	Float		kvar	Primary
kVA_a	34361-34362	0x1108-0x1109	DWord	Float		kVA	Primary
PF_a	34363-34364	0x110A-0x110B	DWord	Float			Primary
kWh_a	34365-34366	0x110C-0x110D	DWord	Float			Primary
kvarh_a	34367-34368	0x110E-0x110F	DWord	Float			Primary
kVAh_a	34369-34370	0x1110-0x1111	DWord	Float			Primary
V_b	34371-34372	0x1112-0x1113	DWord	Float		Volt	Primary
I_b	34373-34374	0x1114-0x1115	DWord	Float		Amp	Primary
kW_b	34375-34376	0x1116-0x1117	DWord	Float		kW	Primary
kvar_b	34377-34378	0x1118-0x1119	DWord	Float		kvar	
kVA_b	34379-34380	0x111A-0x111B	DWord	Float		kVA	Primary
PF_b	34381-34382	0x111C-0x111D	DWord	Float			Primary
kWh_b	34383-34384	0x111E-0x111F	DWord	Float			Primary
kvarh_b	34385-34386	0x1120-0x1121	DWord	Float			Primary
kVAh_b	34387-34388	0x1122-0x1123	DWord	Float			Primary
V_c	34389-34390	0x1124-0x1125	Dword	Float		Volt	Primary
I_c	34391-34392	0x1126-0x1127	Dword	Float		Amp	Primary
kW_c	34393-34394	0x1128-0x1129	Dword	Float		kW	Primary
kvar_c	34395-	0x112A-	Dword	Float		kvar	Primary

	34396	0x112B					
kVA_c	34397-34398	0x112C-0x112D	Dword	Float		kVA	Primary
PF_c	34399-34400	0x112E-0x112F	Dword	Float			Primary
kWh_c	34401-34402	0x1130-0x1131	Dword	Float			Primary
kvarh_c	34403-34404	0x1132-0x1133	Dword	Float			
kVAh_c	34405-34406	0x1134-0x1135					
V_avg(V_d)	34407-34408	0x1136-0x1137	Dword	Float		Volt	Primary
I_avg(I_d)	34409-34410	0x1138-0x1139	Dword	Float		Amp	Primary
kW_tot(kW_d)	34411-34412	0x113A-0x113B	Dword	Float		kW	Primary
kvar_tot(kvar_d)	34413-34414	0x113C-0x113D	Dword	Float		kvar	Primary
kVA_tot(kVA_d)	34415-34416	0x113E-0x113F	Dword	Float		kVA	Primary
PF_tot(PF_d)	34417-34418	0x1140-0x1141	Dword	Float			Primary
kWh_tot(kWh_d)	34419-34420	0x1142-0x1143	Dword	Float			Primary
kvarh_tot(kvarh_d)	34421-34422	0x1144-0x1145	Dword	Float			
kVAh_tot(kVAh_d)	34423-34424	0x1146-0x1147	Dword	Float			
Frequency	34425-34426	0x1148-0x1149	Dword	Float		Hz	After V1.29-3

Modbus Module #4 Input Register : Voltage, Current, Power, Energy(Int) for IPM3400

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	34609-34610	0x1200-0x1201	DWord	UInt32		0.1 Volt	Primary
I_a	34611-34612	0x1202-0x1203	DWord	UInt32		0.1A	Primary
kW_a	34613-34614	0x1204-0x1205	DWord	Int32		0.1kW	Primary
kvar_a	34615-34616	0x1206-0x1207	DWord	Int32		0.1kvar	Primary
kVA_a	34617-34618	0x1208-0x1209	DWord	Int32		0.1kVA	Primary
PF_a	34619	0x120A	Word	Int	-1000~+1000	0.001PF	-1.000~1.000
kWh_a	34620-34621	0x120B-0x120C	DWord	Int32	0~99999999	0.1kWh	0~9999999.9
kvarh_a	34622-34623	0x120D-0x120E	DWord	Int32	0~99999999	0.1kvarh	0~9999999.9
kVAh_a	34624-34625	0x120F-0x1210	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_b	34626-34627	0x1211-0x1212	DWord	UInt32		0.1 Volt	Primary
I_b	34628-34629	0x1213-0x1214	DWord	UInt32		0.1A	Primary
kW_b	34630-34631	0x1215-0x1216	DWord	Int32		0.1kW	Primary
kvar_b	34632-34633	0x1217-0x1218	DWord	Int32		0.1kvar	Primary
kVA_b	34634-34635	0x1219-0x121A	DWord	Int32		0.1kVA	Primary
PF_b	34636	0x121B	Word	Int	-1000~+1000	0.001PF	-1.000~1.000
kWh_b	34637-34638	0x121C-0x121D	DWord	Int32	0~99999999	0.1kWh	0~9999999.9
kvarh_b	34639-	0x121E-	DWord	Int32	0~99999999	0.1kvarh	0~9999999.9

	34640	0x121F					
kVAh_b	34641-34642	0x1220-0x1221	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_c	34643-34644	0x1222-0x1223	DWord	UInt32		0.1 Volt	Primary
I_c	34645-34646	0x1224-0x1225	DWord	UInt32		0.1A	Primary
kW_c	34647-34648	0x1226-0x1227	DWord	Int32		0.1kW	Primary
kvar_c	34649-34650	0x1228-0x1229	DWord	Int32		0.1kvar	Primary
kVA_c	34651-34652	0x122A-0x122B	DWord	Int32		0.1kVA	Primary
PF_c	34653	0x122C	Word	Int	-1000~+1000	0.001PF	-1.000~1.000
kWh_c	34654-34655	0x122D-0x122E	DWord	Int32	0~99999999	0.1kWh	0~9999999.9
kvarh_c	34656-34657	0x122F-0x1230	DWord	Int32	0~99999999	0.1kvarh	0~9999999.9
kVAh_c	34658-34659	0x1231-0x1232	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_avg(V_d)	34660-34661	0x1233-0x1234	DWord	UInt32		0.1 Volt	Primary
I_avg(I_d)	34662-34663	0x1235-0x1236	DWord	UInt32		0.1A	Primary
kW_tot(kW_d)	34664-34665	0x1237-0x1238	DWord	Int32		0.1kW	Primary
kvar_tot(kvar_d)	34666-34667	0x1239-0x123A	DWord	Int32		0.1kvar	Primary
kVA_tot(kVA_d)	34668-34669	0x123B-0x123C	DWord	Int32		0.1kVA	Primary
PF_tot(PF_d)	34670	0x123D	Word	Int	-1000~+1000	0.001PF	-1.000~1.000
kWh_tot(kWh_d)	34671-34672	0x123E-0x123F	DWord	Int32	0~99999999	0.1kWh	0~9999999.9
kvarh_tot(kvarh_d)	34673-34674	0x1240-0x1241	DWord	Int32	0~99999999	0.1kvarh	0~9999999.9
kVAh_tot(kVAh_d)	34675-34676	0x1242-0x1243	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
Frequency	34677	0x1244	Word	UInt16	0~9999	0.01Hz	0.00~99.99 After V1.29-3

Appendix：Question and Answer

Q1. if the turn point of the split type clip on CT break, or inner iron -core break, how to settle this condition?

（1）the measure data will be not accuracy as before, and can not use again。

（2）please do not use the tape to fix it and then re-use again。

Q2. if multiple set of meter are being installed，the split type clip on CT and set of meter are able to take it apart and to mix use？

Please do not mix use，because the set of ct and meter from IA Networks, are all calibrate well and Gain after QC。

Q3. the real power rate（kw）, if the value of measure is negative?

（1）first check the current input end – line terminal, （check the connect is it **1S、1L、2S、2L、3S、3L、4S、4L**），base on white black, white black, white black follow the sequence order。

（2）check the field current is same direction of（K→L）must follow the same direction on the split type clip on CT inner arrow。

Q4. PC and meter can not make the communication？

（1）confirm the Modbus Address，default is 1。

（2）confirm the Band Rate，default is 9600。

（3）confirm the stop bit，default is 2。

（4）confirm the RS485 之 connect line terminal ＋、－is it connect correct。

Q5. Regarding to the combine shipment of the meter with split type CT, what is the maximum dimension？

（1）power line if ＜Φ10 use 60A CT，Φ10～Φ16 use 100A CT，Φ16～Φ24 use 200A CT。

Q6. Regarding to the split type small CT , if the wire is not longer enough ?

（1）Φ10split type CT，fix wire is 1.8M，if need extension, please use the same size wire, and dimension to apply it，the connection part is need to use tinning and insulate tape to cover it the copper。

（2）Φ16and Φ24split type CT，the std. wire of length is 2M, if over 2M you can choice the suitable one to add。